香 港 中 文 大 學
The Chinese University of Hong Kong

Course Examinations　2000—2001　年度科目考試

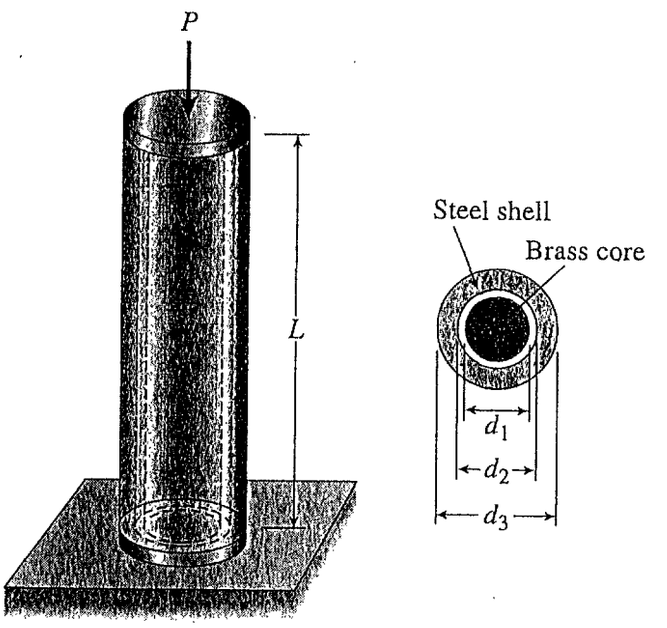
Course Code & Title 科目編號及名稱：MAE 2080 Mechanics of Materials

Time allowed 時間：Two hours 小時 --- minutes 分鐘

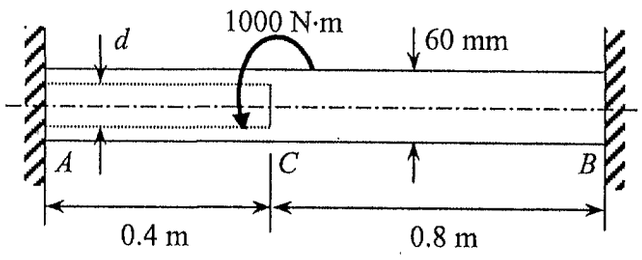
Student I.D. No. 學生編號：　　Seat No. 座號：

This is a closed-book/closed-note exam. Calculators are permitted. Answer all questions (five problems total). The full mark of this exam is 100 points. Show all relevant work and answers on the answer book. Remember to write your student number on the answer book and question paper.

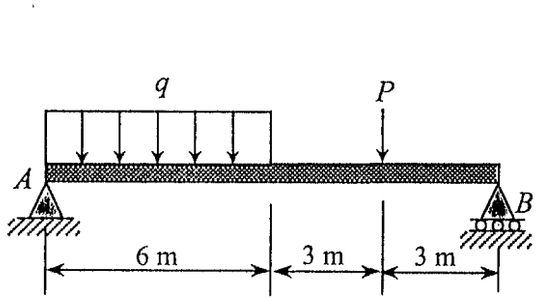
1. (20 points) The assembly shown in the figure consists of a brass core (diameter $d_1 = 6.0$ mm) surrounded by a steel shell (inner diameter $d_2 = 7.0$ mm, outer diameter $d_3 = 9.0$ mm). A load P compresses the core and shell, which have length $L = 85$ mm. The moduli of elasticity of the brass and steel are 100 GPa and 200 GPa, respectively.
   (a) What load P will compress the assembly by 0.1 mm?
   (b) If the allowable stress in the steel is 180 MPa and the allowable stress in the brass is 140 MPa, what is the allowable compressive load P_{allow}? (Disregard the weight of the assembly itself.)

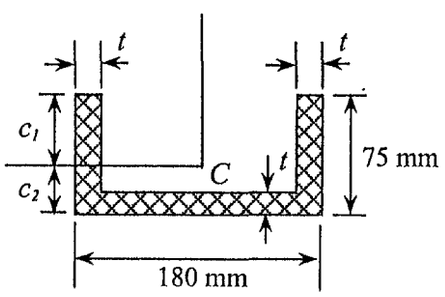


2. (20 points) A circular shaft AB, with 60 mm outside diameter, has a concentric hole of diameter d = 50 mm drilled into portion AC, as shown in the figure. The shaft is fixed at both ends and loaded by a torque at C (see figure). Knowing that the entire shaft is made of steel for which G = 80 GPa, calculate
   (a) the reaction torques at both ends,
   (b) the maximum shear stresses in each segment of the shaft, and
   (c) the angle of rotation at the cross section where the load is applied.

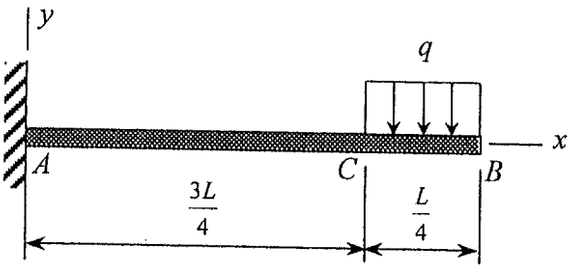


3. (20 points) A beam AB supports a uniform load of intensity q = 2.0 kN/m and a concentrated load P = 8 kN shown in the figure. The beam has cross section in the form of a channel with t = 15 mm (see figure).
   (a) Draw the shear-force and bending-moment diagrams.
   (b) Find the location of neutral axis, c_1 and c_2.
   (c) Determine the maximum tensile and compressive stresses in the beam due to the loads q and P.
   (d) Determine the maximum shear stress in the web of the beam.
   (Disregard the weight of the beam and the areas of the fillets.)

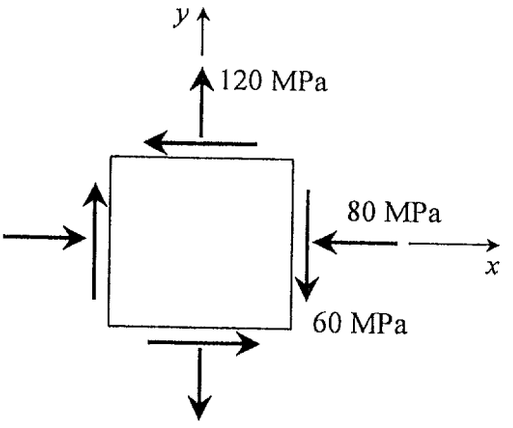




4. (20 points) Derive the equations of the deflection curve for a cantilever beam AB supporting a uniform load of intensity q acting over one-quarter of the length (see figure). Also, obtain formulas for the deflections δ_B and δ_C at points B and C, respectively. (Neglect the weight of the beam.)



5. (20 points) An element in plane stress is subjected to the stress components shown in the figure.
(a) Determine the principal stresses and show the results on a sketch of a properly oriented element.
(b) Determine the maximum shear stresses and show the results on a sketch of a properly oriented element.
(Consider only the in-plane stresses.)



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